Appendix G. Vital signs scoping process and key findings, Klamath Network.

1.1. Vital Signs Monitoring

The vital signs of ecosystem or natural resource health have been likened to the vital signs that a physician would monitor while treating a patient. Vital signs may be direct, surrogate, or derived measures of ecosystem processes or components that can reveal significant information about ecosystem or resource condition. Vital signs may also be the population or community characteristics of selected species or communities of species that are of concern to park managers or the public. The identification of which ecosystem, landscape, or park vital signs to monitor is a most fundamental and important process in the development of the Network Monitoring Plan. The purpose of this document is to summarize this ongoing process for the Klamath Network. In addition, a comprehensive list of all vital signs identified throughout the process is provided at the end of this document.

1.2. Development of Vital Signs Identification Workshops

Appendix G. Vital signs scoping process and key findings, Klamath Network (continued).

Identification of vital signs for monitoring in the Klamath Network has been an ongoing process. Over the last five years and largely before the formal establishment of the Klamath Network Inventory and Monitoring Program, each park unit held scoping workshops to establish vital signs appropriate to the unit. Most parks were frustrated with the initial workshop results, but did come away with some baseline idea for vital signs and the scoping process in general. These lessons learned from these initial park-specific workshops provided direction for subsequent scoping workshops. In April, 2004, the Chiefs of Resources for the network parks and other resource staff met to discuss the earlier workshops and determine any general improvements in the process to incorporate into the Network workshops. The following section presents the key points raised in discussion about the earlier, park-specific workshops.

A. Feedback from Initial Park-Specific Vital Signs Workshops

Crater Lake National Park: Summarized by Mac Brock, Natural Resources Chief, Crater Lake

- Used stressor based process; how is stressor manifested in ecosystem
- #1 mistake: We assumed there would be a healthy, professional, cross-discipline discussion. It didn't happen. People withdrew into their respective disciplines and there was little or no "group think."
- Workshop was personality-driven.
- Liked looking at the process from a stressor-based perspective: the workshop theory was good, but the group dynamics were flawed.
- Got a lot of good knowledge from the workshop but no really useful results.
- Likes the idea of using conceptual models as a framework to get everyone on the same page (the models don't need too much detail for this process).
- Need a better-defined, guided process for the group to work through. Thought they had a good process, but it fell apart.
- #1 positive aspect: invited some social scientists who didn't have the normal biological perspectives. They offered good insight into the social trends that the network is/will be facing.

Other comments:
Eric Beever: Found the use of a moderator to be very useful in these types of processes
Paul DePrey: Should have done in-house scoping before workshops; Jon Arnold. agreed and mentioned that Lake Mead did that and they were pretty happy with the results.

Lassen Volcanic National Park: Summarized by Jon Arnold, Wildlife Biologist, Lassen

- Held the 1st scoping session in the network (5 days long!)
- It was unorganized and not structured; the same probleMarine as everyone else.
- Started with the step-down process (1 day) and moved on to conceptual models (1 hr).
- Developed a mission statement/goals for Lassen's part of the I & M program.
- Included an area of concern outside the boundary in their process.

Appendix G. Vital signs scoping process and key findings, Klamath Network (continued).

- Used the Delphi approach; not multi-faceted; focused on ecosystem integrity.
- Wrote 27 project statements/study designs.
- ProbleMarine:
    - No specific workshop objectives or expected products
    - No packet sent out with conceptual models (this would have been useful)
    - Indicators were selected but there was no real justification for there selection
    - No prioritization of indicators
    - No monitoring questions asked

Lava Beds National Monument: Summarized by David Larson, Natural Resources Chief, Lava Beds

- Stressor-oriented process
- Mainly NPS staff; not enough academic representation; neighboring agencies didn't show up
- Good balance of disciplines
- Not enough time to develop monitoring objectives (needed 1 more day)
- Break out groups were organized by discipline; maybe intermix more
- Were able to ID stressors/human disturbances
- No final report was written but they have a lot of notes
- Not much direction was established for the future of the process

Oregon Caves National Monument: Summarized by John Roth, Natural Resources Chief, Oregon Caves

- Caves and subsurface systeMarine and species were neglected (as usual); no experts on these subjects were present
- Workshop participants focused on their favorite taxa.
- In general, the group came up with some good parameters; however, there was limited knowledge beyond vertebrates and vascular plants.
- Thinks it would have been better if measurement parameters were discussed before the meeting (are we monitoring biodiversity or something else?)
- The meeting was pretty disorganized; people wanted to monitor everything.
- "The things that are easiest to measure, we don't want to measure!"
- No talk about measuring abiotics/physical processes.

Redwood National and State Parks: Summarized by Terry Hofstra, Natural Resources Chief, Redwood

- 41 non-NPS and 24 NPS participants
- Sent out objectives and identified products expected before meeting

- Developed conceptual models for groups to respond to
- Had leader, recorder, and members in 5 groups; gave them issues and concerns for the park
- Work groups refined conceptual models
- Patterns of disturbance was a common theme among groups
- Didn't come up with a monitoring scheme or indicators
- Thought discipline groups should be segregated initially (i.e. at first workshop), but at this point of the process, thinks intermingling people is better.

Additions by Howard Sakai, Wildlife Biologist at Redwood National Park:

- Groups worked well when segregated, but when they were all brought back together, the process fell apart
- Should mix disciplines to keep everyone on the same page

Whiskeytown National Recreation Area: Summarized by Paul DePrey, Natural Resources Chief, Whiskeytown

- Uneven results (e.g. water quality section was good, but deer and turkey made the were selected as vital signs; specialists with strongest personalities "won" the battle for vital signs selection)
- Fairly unhappy with the BOGSAT result of the meeting, so the park tried a Delphi approach (i.e. solicitation of comment from remotely located experts) via email then had two in-park scoping sessions.
- Bottom line: had to work through the process several times to get something acceptable.

1.3. Klamath Network Vital Signs Workshops

The recommended approach for developing a Network Monitoring Program suggests preparing for and holding a network-wide vital signs scoping workshop. In response to this recommendation, the Klamath Network held three workshops. The first, in January 2004, focused on marine resources of Redwood National Park. A second workshop was held in March to focus on geology and soil concerns and the status of mapping. The third, in May 2004, focused on terrestrial, freshwater aquatic, and subterranean ecosysteMarine and the processes shaping them in all six parks. The decision to break the scoping meetings into groups centered on ecosystem types was made based on impressions of what worked and did not work in the earlier park specific scoping sessions (see summary of concerns above). Each meeting produced many pages of notes and associated documents, which are available from the Klamath Network Inventory and Monitoring Program Office. In concert, these meetings generated the list of monitoring questions and associated vital signs presented at the end of this document.

These Klamath Network meetings will be described briefly in chronological order.

Appendix G. Vital signs scoping process and key findings, Klamath Network (continued).

A. Marine Vital Signs Scoping Workshop, January 27-28, 2004

Organized by Howard Sakai, Redwood National and State Parks (REDW)

There are 36 miles of coastline in the Klamath Network at Redwood National Park. These unique coastal resources were the focus of this vital signs workshop.

Marine Workshop List Of Participants

Name	Affiliation
Dr. Sarah Allen	NPS, Senior Science Advisor, Point Reyes National Seashore
David Anderson	REDW, Fish & Wildlife
Karin Anderson	REDW, Cultural
Leonel Arguello	REDW, Vegetation
Dr. Rebecca Beavers	NPS Geologic Resources Division, Denver, CO.
Bonnie Becker	NPS, Cabrillo National Monument
Keith Bensen	REDW, Fish & Wildlife
David Best	REDW, GIS
Dr. Jeff Borgeld	Humboldt State University, Oceanography Dept.
Dr. Milton Boyd	Humboldt State University, Biology Dept.
Dr. Mark Colwell	Humboldt State University, Wildlife Dept.
Karah Cox	Humboldt State University, graduate student, Fisheries Dept.
Dr. Sean Craig	Humboldt State University, Biology Dept.
Dr. Greg Crawford	Humboldt State University, Oceanography Dept.
Dr. Gary Davis	NPS, Channel Islands National Park/Washington D.C.
Dr. John DeMartini	Humboldt State University, Biology Dept
Marie Denn	NPS, Point Reyes National Seashore
Jeff Denny	REDW, Interpretation
Dr. Walt Duffy	Humboldt State University, California Cooperative Fishery Research Unit.
Corky Farley	REDW, Ranger
Dr. Steven Fradkin	NPS, Olympic National Park
Dr. Thomas Gates	Yurok Tribe, Cultural
Valerie Gizinski	REDW, CDPR Ecologist
Dr. Richard Golightly	Humboldt State University, Wildlife Dept.
Chris Heppe	REDW, Geology
Dave Hillemeier	Yurok Tribe, Fisheries
Monica Hiner	Yurok Tribe, Fisheries
Terry Hines	REDW, Fish & Wildlife
Terry Hofstra	REDW, Chief Resource and Science Division
Baker Holden	REDW, Fish & Wildlife
Gregory Holm	REDW, Fish & Wildlife
Dr. Penny Latham	NPS, Pacific West Region, Seattle, WA
Dr. Mary Ann Madej	USGS, Arcata, CA
Kyle Max	REDW, Fish & Wildlife
Jeanne Mayer	REDW, Fish & Wildlife
Kim McFarland	REDW, Cultural
Cara McGary	Humboldt State University, graduate student, Biology Dept.
Katie McGourty	Humboldt State University, Fisheries Dept.
John Mello	California Dept. of Fish and Game
Dr. Rhea Muchow	University of California, Davis, CA

Appendix G. Vital signs scoping process and key findings, Klamath Network (continued).

Dr. Tim Mulligan	Humboldt State University, Fisheries Dept.
Bow O'Barr	REDW, Cultural
Vicki Ozaki	REDW, Geology
Aida Parkinson	REDW, Compliance
Bill Pierce	REDW, Superintendent National Park
Howard Sakai	REDW, Fish & Wildlife
Daniel Sarr	NPS, Klamath I&M Network, Ashland, OR
Kristin Schmidt	REDW, Fish & Wildlife
Dr. Frank Shaughnessy	Humboldt State University, Biology Dept
Richard Sermon	REDW, Superintendent State Park
Terry Spreiter	REDW, Geology
Rebecca Studebaker	Humboldt State University, Fisheries Dept.
Momoko Suzuki	REDW, Vegetation
Wataru Suzuki	REDW, Vegetation
Jim Tilmant	NPS Water Resources Division, Ft. Collins, CO.
Bob Truitt	NPS, Klamath I&M Network, Ashland, OR

Marine Workshop Agenda

Tuesday, January 27

8:30 am Welcome—Bill Pierce, National Park Superintendent, Redwood National and State Parks, Rick Sermon, State Park Superintendent, Redwood National and State Parks

8:40a Introductions/Announcements : Moderator for presentations (Terry Hofstra)

9:00a Overview of Klamath Network Inventory & Monitoring (I&M) Marine Ecosystem Component (Dr. Penny Latham, Dr. Daniel Sarr)
Goals of Scoping Session (Howard Sakai)

9:20a REDW's Coastline: Legislation/Jurisdiction (H. Sakai), Aerial panorama (Greg Holm)

Existing knowledge of marine ecosystem resources:

9:40a Intertidal/subtidal zones (Dr. Milton Boyd and Dr. John DeMartini)

10:10a Marine mammals/seabirds (Keith Bensen)

10:20a BREAK

10:40a Ocean processes: Seasonal conditions, tides, currents, Klamath River plume (Dr. Greg Crawford)

10:55a Geology: Descriptive overview (Dr. Jeff Borgeld)

11:05a Summary of CA Regional Water Quality Control Board 2003 Report (Howard Sakai)

11:10a Estuaries of Redwood Creek and Klamath River (David Anderson)

Overview of Current Marine PrograMarine:

11:20a On-going Park PrograMarine (Greg Holm)

11:30a Intertidal/Subtidal I&M prograMarine (Dr. Tim Mulligan/**Karah Cox,** graduate student, Dr. Sean Craig/Cara McGary, graduate student)

11:50a Water Quality Research in Crescent City (Dr. Boyd/**Karen Warburton,** graduate student)

12:00 Noon **LUNCH**

Park Stressors (Potential stressors identified by park staff) to:

1:00p 1. Natural resources (Kristin Schmidt)
1:10p 2. Cultural resources (Karin Anderson)
1:20p 3. Other stressors? (All participants)

1:40p Scoping Process: An overview (Gary Davis, facilitator)
2:00p Workgroups (Determine WHAT stressors/indicators and WHY chosen)
NOTE: Break-out groups will be determined by attendees.
3:00p BREAK
3:15p Continue in workgroups
4:25p Tomorrow's agenda
4:30p Adjourn

Wednesday, January 28

8:00a Workgroups present summaries of stressors/indicators/rationale
8:30a Workgroups (Begin work on the WHERE, WHEN, and HOW). Relate to goals (especially identifying levels of change needed, developing information necessary for writing project proposals or monitoring. Include data management in discussion?, etc.)
10:00a BREAK
10:20a Continue workgroup scoping
11:30a Present workgroup summaries
12:00 Noon LUNCH
1:00p Present workgroup summaries
1:30p Integrate workgroup comments into an overall conceptual model or ?
2:45p Summarize findings of Scoping Session
3:30p Closeout and Adjourn

Marine Workshop Meeting Summary

On January 27 and 28, 2004, Redwood National and State Parks (REDW) held its first marine scoping workshop at the South Operations Center in Orick. The workshop was held to address the state of the parks' marine resources within 36 miles of coastal jurisdiction. The parks' 2000 General Management Plan states that park managers will inventory marine plants and animals and monitor their conditions. To comply with this requirement, park managers need to know the condition of marine resources and must be able to identify which species to monitor in order to manage, protect, and preserve the health and integrity of the marine resources.

Over 50 participants attended the two-day marine scoping workshop (see the list of participants, above). Participants represented in-park and out-of-park NPS staff, state

agencies (CDFG and CDPR), the Yurok tribe, Humboldt State University (professors and graduate students), and USGS researchers.

The first half day of the workshop was a series of presentations by park staff and professors and graduate students from Humboldt State University describing the existing knowledge of the parks' marine ecosystem. (Presentation summaries are available from the Klamath Network I&M Program.) The remaining day and a half of the workshop was a scoping session facilitated by Dr. Gary Davis of Channel Islands National Park.

The goals of this workshop were to:

1) Determine conditions of current and future marine ecosystem integrity.
2) Identify the stressors that cause abnormal conditions of marine ecosystem health.
3) Identify indicators (vital signs) useful for providing early warnings of impending abnormal conditions of marine ecosystem health.
4) Identify the level of change needed to detect abnormal conditions.
5) Develop information necessary to write project statements for either inventories (for resources too poorly known to identify potential vital signs) or monitoring design studies for the vital signs identified during the workshop.

Three major coastal workgroups (estuary, intertidal zone, and subtidal zone) were identified by participants in the workshop, who worked separately to address each of the park goals. Workgroup notes were summarized by staff at Redwood.

Here is a synopsis of the steps used to determine Redwood National Park's stressors and vital signs.

Step 1. List *stressors* identified by each workgroup for the Estuary, Subtidal, and Intertidal zones.

Step 2. Identify each *stressor* as either an *anthropogenic* or *natural* stressor.

Step 3. List workgroup *vital signs* for each zone.

Step 4. Group stressors and vital signs from steps 1, 2, and 3.
First, we determined commonalities among each zone's stressors, as determined in step 1, for anthropogenic stressors or natural drivers. Second, we identified the vital signs from step 3 that would be useful in providing an early warning sign of abnormal conditions for each of the three zones.

Step 5. Consider each stressor from Step 4 (e.g. oil spills, harvesting, pollution, invasives, human disturbance, shoreline engineering, sediment, and trampling) and identify what vital sign indicator would be useful in providing an "early warning sign" for each of the zones affected by a stressor.

Step 6. Identify some inventory needs based on the workgroup discussions.

Step 7. Prioritize the vital signs from Step 5:
1) Vital sign addresses many stressors (refer to step 5).
2) Stressor is so imminent we must monitor this vital sign.
3) Combination of 1 and 2.
4) Consideration of feasibility.

Step 8. Determine what and how to monitor for vital signs.
Important note: We asked ourselves *"What zone(s) would be the first to capture a change due to an abnormal condition?"*

Step 9. Determine the level of change, in percent, needed to detect an abnormal condition.

Step 10. Develop inventory, monitoring, and research questions.

As part of the decision process, we looked for common ground among the vital signs and came up with the following important "Biggies" vital signs for the marine ecosysteMarine of REDW:

- seabirds
- marine mammals
- invertebrates/algae
- water quality
- fish
- aquatic plants
- meteorology
- visitor use

B. Klamath Network Joint Geology/Soils Scoping Workshop, March 1-4, 2004, Ashland, Oregon

Organized by Klamath Network Inventory and Monitoring Program and NPS Geological Resource Division

The purpose of this meeting was to describe the status of geology and soils maps existing for each Park, and the ongoing and future efforts towards mapping and data acquisition. In addition, resource management staff from individual parks were interviewed by staff of the National Park Service's Geologic Resources Division (NPS GRD), Denver Colorado (Tim Connors, Sid Covington) to identify any concerns related to geology and soils.

Geology Workshop List of Participants

Appendix G. Vital signs scoping process and key findings, Klamath Network (continued).

National Park Service, Denver Colorado: Sid Covington, Tim Connors, Pete Biggam, Ron Kerbo, Anne Poole.
USGS (with Park research affiliation): Charlie Bacon (Crater Lake), Bruce Rogers (Lava Beds), Michael Clynne (Lassen Volcanic, via conference call), Julie Donnaly-Nolan (Lava Beds, via conference call), Mary Ann Madej (Redwood).
California Water Quality Board: Guy Chetelet (Whiskeytown).
Oregon Geologic Survey: Tom Wiley (Crater Lake, Oregon Caves).
Natural Resources Conservation Service: Dave Smith (California State Soil Scientist, Lava Beds, Lassen Volcanic, and Whiskeytown), Joe Seney (Redwood), Jerry Weinheimer (Crater Lake).
National Park Service: Daniel Sarr (Klamath Network), Bob Truitt (Klamath Network), Hanna Waterstrat (Klamath Network), Dennis Odion (Klamath Network), Vicki Ozaki (Redwood), Brian Rasmussen (Whiskeytown), John Roth (Oregon Caves), Deana DeWire (Oregon Caves), Louise Johnson (Lassen Volcanic), David Larson (Lava Beds), Mac Brock (Crater Lake), Marsha Davis (Regional).

Geology Workshop Agenda

One half to a full day was devoted to each of the six park units. The following topics were discussed:

- Geology mapping status (Connors)
- Soils mapping status (Biggam)
- Soils and geologic issues (Biggam/Covington)

Geology Workshop Meeting Summary

A summary of mapping status for geology and soils is provided in Attachment 1. The following geologic and soils resources and issues were discussed for each park.

1) **Geological Issues**
   - **a)** Fluvial
   - **b)** Groundwater
   - **c)** Hazards (e.g. volcanic, debris flows, landslides, tsunamis, seismic activity, mines.)
   - **d)** Paleontology
   - **e)** Cave and Karst
   - **f)** Unique Geological Features
   - **g)** Geological Interpretation

2) **Soils Issues**
   - **a)** Terrestrial—there is some trail erosion, but it is minimal and manageable.
   - **b)** Climate change—may affect snowpack and soil moisture.
   - **c)** Disturbance regimes
   - **d)** Invasive Plants
   - **e)** Grazing history

f) Critical habitat
g) Buildings/facilities
h) Serpentinitic soils
i) Past land use issues
j) Soil mycorrhizae inventory needed.
k) USFS has Forest Health Monitoring plots in the area. NPS wants to know where these plots are.

Monitoring needs and priorities for Geology and Soils issues were then discussed for each Park unit. The meeting did not identify specific vital signs, but provided a wealth of information on geologic and soils concerns for consideration in the development of vital signs for monitoring. (Detailed notes are available from the Klamath Network or from Sid Covington or Tim Connors, NPS, Denver, CO.see NPS Geologic Inventory Fact Sheet).

C. Klamath Network Vital Signs Scoping Workshop, May 4-6, 2004, Ashland, Oregon

Organized by Klamath Network Inventory and Monitoring Program

May 2004 Vital Signs Scoping Workshop List of Participants

Group	LastName	FirstName	Park/Affiliation
F	Denn	Marie	PWR
A	Truitt	Bob	KLMN
A	Buktenica	Mark	CRLA
A	Bury	Bruce	USGS
A	Currens	Chris	USGS SAC
A	Hofstra	Terry	REDW
A	Marchetti	Mike	CSU Chico
A	Milestone	Jim	WHIS
A	Nordensten	Nancy	LAVO
A	Ozaki	Vicky	REDW-SOC
A	Parker	Michael	SOU-Biology
A	WilliaMarine	Jack	SOU-AuCoin Inst.
A	Cofer	Matt	SOU
AN	Miller	Rebecca	KLMN
P	Odion	Dennis	UC Santa Barbara
P	Brock	Mac	CRLA
P	Gross	John	NPS Ft. Col
P	Madej	Mary Ann	USGS
P	Shafer	Sarah	USGS
PN	Smith	Sean	SOU
S	Roth	John	ORCA
S	DeWire	Deana	NPS ORCA
S	Kerbo	Ron	NPS, Denver

Appendix G. Vital signs scoping process and key findings, Klamath Network (continued).

S	Larson	Dave	LABE
S	Seiring	Patricia	HSU-Biology
SN	Waterstrat	Hanna	KLMN
T	Arguello	Leonel	REDW
T	Alexander	John	KBO
T	Arnold	John	LAVO
T	Atzet	Tom	USFS Ret.
T	Beever	Erik	USGS
T	Clynne	Michael	USGS SAC
T	D-Allura	Jad	SOU
T	Janes	Stewart	SOU-Biology
T	Jessup	Steve	SOU-Biology
T	Lang	Frank	SOU Ret.
T	Latham	Penny	PWR-CCSO-Seattle
T	Laudenslayer	Bill	USDA
T	Magnuson	Mike	LAVO
T	Murray	Michael	CRLA
T	Peterson	Arnie	LAVO
T	Sarr	Daniel	KLMN
T	Waldien	Dave	Oregon State University
TN	Shaw	Beverly	KLMN

Groups: F=Facilitator, A= Aquatic, P=Process, S=Subterranean, T=Terrestrial. N=Notetaker. Group leaders' names are highlighted.

May 2004 Vital Signs Scoping Workshop Meeting Agenda

Tuesday - May 4

1:00 - 1:10 PM	Welcome, Introductions, Goals	Jim Milestone, Superintendent Whiskeytown NRA
1:10 - 1:50 PM	Introduction to the Workshop Meeting Logistics, Goals	Marie Denn Aquatic Ecologist Pacific West Region
1:50 - 2:20 PM	Monitoring Goals, Target Audiences, etc.	Penny Latham I&M Coordinator Pacific West Region
2:20 - 2:40 PM	Overview of the Klamath Network Inventory and Monitoring Program	Daniel Sarr I&M Coordinator Klamath Network
2:40 - 2:50 PM	**Break**	
2:50 - 3:20 PM	Monitoring of Federal Lands in the PNW: General Principles, Strategies, and Indicators	Erik Beever Ecologist USGS FRESC

Appendix G. Vital signs scoping process and key findings, Klamath Network (continued).

3:20 – 3:50 PM	Introduction to Conceptual Models for Ecosystem Monitoring	John Gross Lead Ecologist, National Inventory and Monitoring Program
3:50- 4:00 PM	**Break**	
4:00 – 4:20 PM	Klamath Network Conceptual Models A Roadmap for Vital Signs Monitoring	Dennis Odion Ecologist Southern Oregon University
4:20 – 4:45 PM	Resource Management and Monitoring Issues in the Klamath Network	Daniel Sarr
4:45 - 5:00 PM	Overview of Activities for Day 2, Questions	Marie Denn
5:00 PM	**Adjourn**	

Wednesday, May 5

8:00 – 8:15 AM	Marching Orders for Break Out Groups	Marie Denn
8:15 - 10:00 AM	Break Out Groups: Conceptual Model Refinement & Monitoring Questions Brainstorming	Working Groups
10:00 - 10:15 AM	**Break**	
10:15 - 12:00 AM	Continue Monitoring Questions Brainstorming & Prioritization	Working Groups
12:00 – 1:15 PM	**Lunch**	
1:15 - 2:00 PM	Working Group Ten Minute Reports on Monitoring Questions	Group Leaders
2:00 - 2:10 PM	Intro to Vital Signs Scoping	Marie Denn
2:10 - 3:00 PM	Break Out Groups: Vital Signs	Working Groups
3:00- 3:15 PM	**Break**	
3:15 – 5:00 PM	Continue Vital Signs Working Groups	Working Groups
5:00 PM	**Adjourn**	

Thursday - May 6

8:00 -8:15 AM	Welcome Back	Marie Denn
8:15- 10:00 AM	Break Out Groups: Vital Signs	Working Groups
10:00 –10:15 AM	**Break**	
10:15 -12:00 AM	Working Groups Review Key Vital Signs	Group Leaders

Appendix G. Vital signs scoping process and key findings, Klamath Network (continued).

	Why is Vital Sign Important? Development of Monitoring Objectives Existing Protocols and Methodologies Potential Partnerships and Cost Sharing	
12:00 – 1:15 PM	**Lunch**	
1:15 – 2:00 PM	Continue Vital Signs Review	Working Groups
2:00 – 3:00 PM	Working Group Ten Minute Reports	Group Leaders
3:00 - 3:15 PM	**Break**	
3:15 – 3:45 PM	Wrap Up and Close Out Thanks to Participants	Marie Denn, Daniel Sarr
3:45 – 4:30 PM	Network staff meet	Daniel Sarr
4:30 PM	Adjourn	

May 2004 Vital Signs Scoping Workshop Meeting Summary

The May Vital Signs Scoping Workshop actually consisted of three meetings: a pre-workshop meeting in April, the actual workshop, and a follow-up meeting in June.

Pre-workshop meeting - On April, 2004, the Klamath Network Science Advisory Committee (SAC) held the pre-workshop meeting to lay the groundwork and create guidelines for the workshop (vital signs scoping meeting) in May. The SAC decided on the following:

- In the interest of capturing ideas, don't throw away any ideas at this point (in other words, leave the floor open to park-specific and network-wide concerns).
- Obtain information on on-going research by other agencies that might be useful to the network.
- Ask the participants to bring a CD with references relevant to the stressors.
- Send out pre-meeting conceptual models.
- Plan workgroups based on ecosysteMarine, not taxa groups.
- Identified ecosystem groups (terrestrial, subterranean, freshwater aquatic) and other breakout groups (water quality, ecosystem processes).

May Vital Signs Scoping Workshop – At the main workshop, Klamath Network staff and NPS and USGS Scientists provided a half-day overview describing the efforts to develop monitoring prograMarine nationwide, and highlighted the issues specific for Klamath Network parks. The process for developing a monitoring program was presented. This process includes identification of broad multi-park issues, development of conceptual models of park ecosysteMarine and their vulnerability to human impacts, and the means for inviting feedback from the scientific community.

Appendix G. Vital signs scoping process and key findings, Klamath Network (continued).

Workshop participants then broke into the ecosystem or process-based working groups for a sequential three phase process: (1) Review and refinement of the network conceptual models, (2) Brainstorming of potential monitoring issues and questions, (3) Proposals of indicators (vital signs) for inclusion in the monitoring program that will help park staff track and address the issues and questions raised. Group leaders and note takers were assigned to each group to facilitate discussion and to capture important suggestions, questions, and proposals.

Each group spent a couple hours critiquing the conceptual models that had been developed by the Klamath Network. These models were considered a good starting point for explaining Park ecosysteMarine. The main criticisMarine were that these models need to be linked to biophysical processes and that they were biased in favor of plants.

The bulk of each group's time was spent brainstorming monitoring questions, and then linking these questions with vital signs to monitor. The groups were directed to attempt to find a clear nexus between each vital sign and a monitoring question. This was a creative exercise in which all ideas were considered without concern for feasibility or priority. There was some confusion over the concept of a vital sign and a measurement.

Each group used the National Vital Signs Framework that was developed by Dr. John Gross for an organizational template and considered the following questions while brainstorming:

Ecosystem Description

- What are the major subunits of your ecosystem type (alpine, coastal strand)? Do they warrant special consideration?
- Are other conceptual models needed for specific habitats, populations, etc.? If so, why do they merit additional detail?
- What are the major threats to this ecosystem type?

Ecosystem Structure

- What are the primary gradients or characteristics structuring the ecosysteMarine of interest?
- What biological elements create desirable structure in the ecosystem?
- What are factors creating and maintaining natural landscape patches?
- What are the relatively rare habitats? Wetlands? Outcrops?, Caves? Serpentine sites? Kipukas? Geothermal sites? Are they well understood?
- What structural elements are most at risk?
- What are the landscape factors or processes the create heterogeneity within the park? Climate? Elevation? Soils? Disturbance? Vegetation?

Ecosystem Composition

- What are the major units of interest? (e.g., Populations?, Communities?, Geologic types? etc.)

Appendix G. Vital signs scoping process and key findings, Klamath Network (continued).

- Where are the hot spots and cold spots of species diversity in your ecosystem? Do they coincide for many species?
- What are the focal species or landscape elements?
- What are the ecosystem elements that are most at-risk?

Ecosystem Function
- What are the critical functions in the ecosystem(s)?
- Which of these functions are most susceptible to human impacts?

The monitoring questions identified by each group are shown in Tables 1 through 6. Since the focus of the process group was to identify the most important monitoring questions related to processes, they did not focus on identifying vital signs. In addition to the specific questions identified in the following tables, the process group identified these important broader questions to consider in developing a monitoring program:

- Regarding the natural range of variation, where to cut off extremes?
- How long-term will the monitoring be?
- How can we monitor extreme events that dominate change?
- How can we incorporate past uncertainty into a changing world?
- What variable can be a metric for climate change?
- Which effects of climate change are best to monitor?
- Can baseline data show what to monitor? Sufficient baseline monitoring is key to any monitoring program.

Follow-up Meeting - Following the meeting, Klamath Network staff compiled all the monitoring questions and meeting notes into a summary report for review by natural resource staff in the parks and by all who participated in the meetings. This report was mailed to the Science Advisory Committee, and a follow-up meeting with the Science Advisory Committee took place in June, 2004 to further refine the questions and vital signs identified in the entire process up to this point. More refinements were made as a result of email discussions. The final findings will be incorporated into the Klamath Network Phase I Monitoring Report and eventually into its Vitals Signs Monitoring Plan.

The list of monitoring questions and associated candidate vital signs from both scoping workshops is presented in upcoming tables (Tables 2-7). The tables are formatted to the main (level 1) categories of the National Framework for vital signs. In order to understand the full National Framework for Vital Signs, Table 1 is provided. It lists all the level 1 categories, and the subcategories (level 2), as well as example vital signs and measurements for each subcategory.

Appendix G. Vital signs scoping process and key findings, Klamath Network (continued).

Table 1. National Vital Signs Framework.

Level 1	Level 2	Vital Sign (example)	Measurement (examples)
Air and Climate	Air Quality	Air Chemistry - ozone	Atmospheric ozone concentration, foliar ozone damage
	Weather	Weather/Climate change	Precipitation (snow, rain, fog, etc.), temperature, wind speed and direction, solar radiation, relative humidity
Geology	Geomorphology	Windblown features and processes	Size, shape and position of sand dunes and loess deposits, volume of sediment moved, wind speed and direction
	Subsurface Geologic Processes	Geothermal features and processes	Water temperature, discharge rate, water and gas chemistry, chloride flux, heat flow
	Disturbed Lands	Abandoned Mine Lands	Radioactivity, mine drainage, contamination (pH, lead, zinc, mercury etc.)
	Other	Paleontology	Erosion rates
Soil	Soil quality	Soil erosion	Changes in thickness of topsoil, rill and gully density/dimensions, pedestals, terracettes
Water	Hydrology	Groundwater dynamics	Depth to groundwater, well recharge rate
	Water Quality	Water Chemistry	4 core (pH, DO, conductance, temp), cations (Ca, Mg, Na, K), anions (PO4, NO2, Br, SO4, Cl, acid neutralizing capacity), turbidity, suspended sediments, BOD, COD, alkalinity, Secchi disc
Biological Integrity	Invasive Species	Occurrence of invasive plants & animals	Distribution of cheat grass; % non-native fish in sample, etc.
	Focal species or communities	Marine Vegetation	Seagrass distribution
	At-risk biota	Significant populations	Abundance of species X
	Predominant plant communities	Forest community structure and demography	Ponderosa pine (oak, etc.) stand size structure
Human use	Point source human effects	Chemical contamination	Extent of oil soiling of beach; acres contaminated by mine drainage
	Non-point source human effects	Dark night skies	Number of visible stars
	Consumptive use	Wildlife harvest	Elk killed in Gardiner hunt; moose permits in Wrangell-St Elias
	Visitor and recreation use	Natural sound levels	Sound levels in remote areas, sound from overflights
Ecosystem pattern and processes	Fire	Fire dynamics	Size, intensity, return interval
	Land use	Land use	Road density, housing density, recreational use intensity
	Land cover	Land cover	Area of dominant land cover types
	Nutrient dynamics	Nutrient turnover	C, N, P dynamics in aquatic or terrestrial systeMarine
	Productivity	Biomass production	biomass production in aquatic or terrestrial system Marine. NDVI-derived vegetation growth index, etc.

Appendix G. Vital signs scoping process and key findings, Klamath Network (continued).

The origin of each monitoring question and/or vital sign (i.e. Marine Scoping, terrestrial, aquatic, subterranean, or process group, or individual park abbreviation) is indicated in the following tables. We will use this listing of monitoring questions and potential vital signs to begin our Phase II Prioritization process in FY 2005.

Table 2. Monitoring questions and potential vital signs for National Framework,level 1, Air Quality and Climate category.

Subcategories	Monitoring Questions	Vital Signs (Klamath)	Question Identified by	Comments (June 04 SAC, and follow-up email)
Air Quality	What is the relative importance of the air and climate on terrestrial communities?	research question	Terrest.	
	Atmospheric chemistry	ozone, CO2, others		
	What are status and trends in Wet/dry deposition?	pollutants (deposition S & N, particulates)	Terrest.	
		acid deposition	Terrest.	
		sensitive species (amphibians lichens, plants)	Terrest.	
		biotic/abiotic responses	Terrest.	
	What are deposition effects on aquatic systems?	species composition, water quality	Aquatic	
		snowpack chemistry		
	what is the deposition as a result of wildfire and prescribed fire?	post fire--wet/dry deposition	Aquatic	
	How is visibility changing?	visibility	Process, Terrest.	
			Terrest.	
	What is the change in light pollution	light at night		

Appendix G. Vital signs scoping process and key findings, Klamath Network (continued).

Subcategories	Monitoring Questions	Vital Signs (Klamath)	Question Identified by	Comments (June 04 SAC, and follow-up email)
	over time?			
	How are air flow (quantity and quality) changes affecting cave resources and processes?	Air Flow	Cave	
		biotic/abiotic responses		
		microclimate		
		Solubility (Rock Solution)	Cave	
		Biota (as indicators of change)	Cave	
		Global Warming (CO2)	Cave	
	Which air flow changes are anthropogenic?	research question (ask john)		
Weather (Climate)	What is time and location of snowpack (melting, duration, depth)?	snow, ice dynamics	Process, Terrest., Aquatic	
	What are the trends in the frost snow free period?	snow frost free period	Terrest.	
	What is timing and duration of key phenological events?	phenology of specific events (which events?)	Process, Terrest., Aquatic	
			Process, Terrest.	
	Are climate associated ecotones changing through	treeline		

Appendix G. Vital signs scoping process and key findings, Klamath Network (continued).

Subcategories	Monitoring Questions	Vital Signs (Klamath)	Question Identified by	Comments (June 04 SAC, and follow-up email)
	time (treeline, other veg types)?			
	How are species distributions changing?	New park species	Terrest.	
	Are edge positions changing?	ecotones, elevational boundaries	Terrest.	
	What is the frequency and duration of climate-induced diseases and insect infestations?	insects and disease listed below	Process	
	What is the susceptibility of communities (ecosystem) to environmental change?	research Q	Process	
	How does climate change effect nutrient cycling?	research Q	Terrest.	
	What entities are easily stressed?	research Q	Process	
	Are there changes in fog days near marine environments?	fog days	Terrest.	
			Terrest.	
	Fog, how far inland fog distribution			

Appendix G. Vital signs scoping process and key findings, Klamath Network (continued).

Subcategories	Monitoring Questions	Vital Signs (Klamath)	Question Identified by	Comments (June 04 SAC, and follow-up email)
	and how long?	and dynamics		
	How do ENSO and climate change affect marine and terrestrial organisMarine	Common Murre, Harbor seals, bull kelp, marbled murrelets, songbirds	Marine, REDW	Productivity, % cover and composition, breeding success
	What climate changes are associated with El Nino?	Meteorology	Marine, REDW	Temperature, wind direction, wind speed, precipitation. Effects tied to monitoring common murres and invertebrates/algae communities and/or populations
	Are there changes in storm severity How is sea level changing?	marine invertebrates (including phytoplankton)	Marine	% cover
		sea level	Marine	Invertebrate and algae community
		marine substrate type	Marine	Habitat/substrate monitoring
		ocean temperature	Marine	Annual and seasonal temperatures
		marine ephemeral algae (red algae)	Marine	Composition changes, seasonality
		marine algae (esp. bull kelp)	Marine	% Cover, presence/absence, distribution
		intertidal zonation	Marine	Invertebrate and algae community
		estuary morphology	Marine	Sand berm profiles
		meteorology	Marine	Water temperature, wind direction and

Appendix G. Vital signs scoping process and key findings, Klamath Network (continued).

Subcategories	Monitoring Questions	Vital Signs (Klamath)	Question Identified by	Comments (June 04 SAC, and follow-up email)
		(local climate)		speed, precipitation
	How are ocean processes changing	tides	Marine, REDW	Daily fluctuations (from buoy stations)
		nearshore currents	Marine	Direction and speed.
		waves	Marine	Wave spectra - especially height and period.

Appendix G. Vital signs scoping process and key findings, Klamath Network (continued).

Table 3. Monitoring questions and potential vital signs for National Framework, level 1, Geology and Soils category.

Subcategories	Monitoring Question	Vital Sign (Klamath)	Question Identified by	Comments (June 04 meeting and follow-up email)
Geomorphology	Have rates, extent, location, or types of erosional and depositional processes changed?	Bank erosion	Process	anticipatory vital signs JG--Question of scale MB--turbidity JG--Marine geomorphology
		sheet erosion	Process	
		gully formation	Process	
		Turbidity	SAC	
	How to capture extreme events?--How are ecosystems changing episodically	(See ecosystem patterns and proc.)	Process, Aquatic	recommendation
	Is mass wasting occurring (and to what degree)?	mass movements	Process, Terrest.	baseline data vital
		channel morphology	Aquatic	
Subsurface Geologic Processes		Cave collapses	SAC	see water quality--see geologic scoping reports
		Temperature gradients	SAC	
		Chemical gradients	SAC	
Marine Geologic Processes		Sediment Deposition, Supply and Transport	Marine	Deposition rates of nearshore sediment, assess coastal rivers (products delivered to coastal zone: pollutants, water and sediment discharge), sediment maps (volume/thickness, characteristics) (equivalent to terrestrial soils maps).

Appendix G. Vital signs scoping process and key findings, Klamath Network (continued).

Subcategories	Monitoring Question	Vital Sign (Klamath)	Question Identified by	Comments (June 04 meeting and follow-up email)
		Coastal Morphology and Change	Marine	Spatial and temporal change in coastal features and relative shoreline position (including shoreline accretion/erosion rates), beach and rocky shoreline profiles, sediment and large wood characteristics. Coastal landslides/slumps mapping. Note: potential to use coastal remote sensing (Lidar and aerial photographs).
Disturbed Lands				Logging roads--lava flows--earthquakes
Soil quality	Are we losing topsoil?	topsoil integrity	Terrest.	
	What are the long term trends in productivity?	Vegetation production	Terrest.	some sites aren't productive
Soil quality	Are processes affecting soil fertility?·	Soil fertility	Process, Terrest.	
		Nutrient deposition in soils		
	Is the carbon loading increasing?	Soil carbon	Terrest.	
	Is visitor use causing soil compaction?	soil compaction	Process, Terrest.	
	Is the vertical structure in biological soil crusts changing over time?		Terrest.	
	What are changes in extent of soil crust?	Biological soil crusts	Process, Terrest.	

Subcategories	Monitoring Question	Vital Sign (Klamath)	Question Identified by	Comments (June 04 meeting and follow-up email)
Subterranean	How can we detect anthropogenic changes in soil?	Soil structure, stability, volume, and composition	Cave	
		Soil biota	Cave, Terrest.	
		Erosion	Cave	

Table 4. Monitoring questions and potential vital signs for National Framework, level 1, Water Quality category.

Subcategories	Monitoring Question	Vital Sign (Klamath)	Question Identified by	Comments (June 04 SAC)
Hydrology	What is the effusion rate of groundwater into the surface environment? (geothermal)	groundwater dynamics (discharge)	Process	
	What are ground water changes?	aquifers (depth volume variability)	Aquatic	
		hyporheic zones	Aquatic	
	What is happening with the hydrological cycle?		Terrest.	
	What are trends in soil moisture across vegetation habitats.	evapotranspiration	Terrest.	
	Hydrothermal output into aquatic system	aquatic chemistry	Process	
	seepage	groundwater (discharge composition)	SAC	
	water flow (water supply)	Water flow	SAC	
		water supply	Process, Aquatic	
Subterranean	How are changes in water and ice quantity, rates, and quality affecting erosion, deposition,	Water Flow (quantity)	Cave, Aquatic	

Appendix G. Vital signs scoping process and key findings, Klamath Network (continued).

Subcategories	Monitoring Question	Vital Sign (Klamath)	Question Identified by	Comments (June 04 SAC)
	and biota?	Distribution (Water/Ice Budget)	Cave, Aquatic	
		Crustaceans and worMarine	Cave, Aquatic	
		Water Chemistry (quality)	Cave, Aquatic	
		MicroorganisMarine	Cave	
Water Quality	Point source pollution	pollutants (inorganic)	Process, Marine	
	Non point source pollution	pollutants (organic)	Marine	
		water chemistry	Process, Aquatic	
		nutrient levels	WHIS WS	
	Watercraft emissions	Hydrocarbon deposition	SAC	
	Aquatic biological communities	aquatic organisMarine	Aquatic	benthic algae, canopy cover, macroinvertebrates, fresh water mussels, substrate
		water (physical)	Aquatic	
	When and how much water is occurring in ephemeral systeMarine and can we detect a change over time?	vernal pools	Terrest.	
		ephemeral streaMarine	SAC	
		littoral ponds (CRLA)	SAC	
		Seasonal wet meadows (LAVO)	SAC	
		snow melt beds	SAC	

Appendix G. Vital signs scoping process and key findings, Klamath Network (continued).

Subcategories	Monitoring Question	Vital Sign (Klamath)	Question Identified by	Comments (June 04 SAC)
	Is the size and distribution of perennial water bodies (streaMarine, lakes, snow fields, springs, wetlands) changing over time?	distribution of water bodies	Aquatic	
	What are the extent of material, biological, and chemical pollution in marine ecosystem.		REDW MARINE	
	What are status and trends in marine trash (material trash)	seabirds	MARINE	Percent of beached marine seabird carcasses with attached debris
	What are status and trends in the following:	marine mammals		percent of beached marine mammal carcasses with attached debris
	-terrestrial source pollution in intertidal		MARINE	
	-oil	oil, seabirds	MARINE	Presence/absence of oiled beach marine seabird carcasses
		marine mammals	MARINE	Presence/absence of oiled beach marine mammal carcasses
	-river discharged pollution	pollutants	MARINE	Similar water quality testing as done by State Water Quality Control Board
	-salinity	surface salinity	MARINE	Annual and seasonal variations in open ocean and estuary

Appendix G. Vital signs scoping process and key findings, Klamath Network (continued).

Subcategories	Monitoring Question	Vital Sign (Klamath)	Question Identified by	Comments (June 04 SAC)
	-turbidity/clarity	turbidity	MARINE, VSA	NTUs, Light penetration in estuary, intertidal and subtidal zones, extent of turbid river plumes
	Sea surface/subsurface Temperature	Sea surface/subsurface Temperature	MARINE WS	Annual and seasonal variations of water samples in open ocean
	Dissolved oxygen	Dissolved oxygen	REDW MARINE	Annual and seasonal water sample variations in estuary
	What are effects of upstream management on estuaries (daMarine, flow regulation, water quality)?	water temp. (estuary)	MARINE	
		Chlorophyll A	MARINE	Annual and seasonal variations of water samples in estuary
		Coliform bacteria	REDW MARINE	Annual and seasonal variations of water samples in estuary
		Forest Herbicides	REDW	Annual and seasonal variations of water samples in estuary
	What are effects of upstream management on estuaries (land use)?	dissolved oxygen (estuary)	MARINE	Annual and seasonal variations in estuary

Appendix G. Vital signs scoping process and key findings, Klamath Network (continued).

Table 5. Monitoring questions and potential vital signs for National Framework, level 1, Biological Integrity category.

Subcategories	Monitoring Question	Vital Sign (Klamath)	Question Identified by	Comments (June 04 SAC)
	Is the biological integrity (diversity, function, process etc.) of terrestrial. ecosysteMarine being maintained?	**specific communities brought up wrt this question**	Process	
		redwood forest	Process, Terrest.	
		Ponderosa pine	Terrest.	
		True oak recruitment	Terrest.	
		Knobcone pine	Terrest.	
		shrub vegetation	WHIS	
		Little Bald Hills	Terrest.	
		aspen	Terrest.	
		wildlife	Terrest.	
	Is the biological integrity (diversity, function, process etc.) of old growth communities being maintained?	old growth structure composition and function	Terrest. Process	
		old growth spatial extent, juxtaposition	Terrest. Process	
		old-growth, biological indicators	Terrest. Process	
	Is there representation of all serial stages, organisMarine	see ecosystem PP, species richness	Terrest.	

Appendix G. Vital signs scoping process and key findings, Klamath Network (continued).

Subcategories	Monitoring Question	Vital Sign (Klamath)	Question Identified by	Comments (June 04 SAC)
	Is there loss of species or genetic diversity?	species composition, dist.	Terrest.	
	What are stand scale trends in terrestrial communities?		Terrest.	
	Status and trends in second growth forests?	second-growth forests	Terrest.	
Disturbance	Will the range type and extent of disturbances extant maintain the biological integrity of the ecosystem?	research Q	Process	
	How have anthropogenic processes affected disturbance regimes?	research Q	Process	
	Are we maintaining natural disturbance regimes and processes?	fire	Process	
		flood, debris flow		
		wind throw		
	Are these maintained at appropriate spatial and temporal scales?	vital sign?	Process	
Herbivory	How is herbivory temporally and spatially distributed within the network?	Livestock, deer, gophers → aspen, predators	Process, Terrest.	
	How is herbivory changing?	native grasses	Terrest.	
		Livestock, deer, gophers → aspen, predators	Terrest.	

Appendix G. Vital signs scoping process and key findings, Klamath Network (continued).

Subcategories	Monitoring Question	Vital Sign (Klamath)	Question Identified by	Comments (June 04 SAC)
Invasive Species	How are invasive species affecting following aquatic and terrestrial ecosystem processes?	Invasive species	Process, Terrest., Marine, Aquatic	research Q?
	-Water levels		Process	research Q?
	-Fuel loads -> fire	non-native plant biomass	Process, Terrest.	research Q?
	-Micro climate	invasive plants	Process	research Q?
	-Species composition	invasive plants fish amphibians, and birds	SAC	Bullhead catfish distribution and abundance in Redwood Creek research Q?
	-Productivity	productivity	SAC	research Q?
	-Landform stability, soil processes, wildlife	?	SAC	research Q?
	What are the trends in distribution and abundance of western junipers through time?	pine-juniper trends	Terrest.	
	What are the trends in distribution and abundance of non-native species through time?	Non-native species	All	
		non-native plant biomass	terrest.	
		invasive plants	terrest	
		invasive fish amphibians, and birds	all	
		pathogens	all	
		non-native insects	terrest.	

Appendix G. Vital signs scoping process and key findings, Klamath Network (continued).

Subcategories	Monitoring Question	Vital Sign (Klamath)	Question Identified by	Comments (June 04 SAC)
Invasive Species	What is going on with invasive species (abundance, distribution, composition)?	Non native vegetation (e.g. canary reed grass) and predatory sea slugs and sea stars on barnacle/mussel communities	marine, terrest	extent cover
	Are invasive species affecting recovery of listed species?	Spotted owls/Barred Owls, Native Amphibians & Fishes/ Bullfrogs,	marine, terrest	Productivity, fledgling success, native amphibians and fishes
	What non-native species pose threats in park estuarine and marine habitats?	Research/inventory question	Marine	Canary reed grass in Redwood Creek Estuary
	Are the population stability/community structure/ of invasive aquatic species changing over time	aquatic invasives	Marine	
	Effects of non-native pathogens?	pathogens	?	research Q?
Infestations and Diseases	Are parasites and diseases expanding in abundance or distribution?	Insect infestations	Terrest.	
		Parasites (cowbirds)	Terrest.	
	Are there interactions with fire?	research Q	Terrest.	
	What are parasite/pathogen trends in terrestrial and marine systeMarine	pathogens (including human diseases, marine mammals)	Marine	

Appendix G. Vital signs scoping process and key findings, Klamath Network (continued).

Subcategories	Monitoring Question	Vital Sign (Klamath)	Question Identified by	Comments (June 04 SAC)
		Carcasses (birds, fish, mammals)	Marine	Species, number, location, oil presence, cause of death, signs of disease or infestation.
		diseased fish, birds, and mammals (both marine and freshwater)	Marine	Species, number , location, and signs of disease or infestation.
		Invertebrate Populations (e.g., mussels, razor claMarine)	Marine	Percent cover, tissue tests for diseases (demoic acid)
		marine mammal behavior	Marine	Number of strandings, and location of strandings
		Red tide	Marine	area of coverage, aerial photography
		Mussel Watch Data	Marine	mussel population/community
Focal Species or Communities	What are long term trends, abundance, distribution, demographics especially productivity, of focal species?	uncharacteristically abundant native species (people?, juniper)	Terrest.	
	What is the presence and distribution of early succession species?	early successional species	Terrest.	
		Terrestrial – birds, mammals, amphibians, reptiles, freshwater aquatic species	REDW	Changes in population trends of birds, mammals, amphibians, reptiles, and freshwater aquatic species.

Appendix G. Vital signs scoping process and key findings, Klamath Network (continued).

Subcategories	Monitoring Question	Vital Sign (Klamath)	Question Identified by	Comments (June 04 SAC)
Terrestrial	What are wildlife and plant demographic trends in focal species)?	whitebark pine forests	Terrest.	
		butterflies	Terrest.	
		landbirds	Terrest.	
		waterbirds	WHIS	
		Biocontrol insects	Terrest.	
		Small mammal communities	Terrest.	
		herpetofauna	WHIS	
		large carnivores → charismatic fauna/megaflora	Terrest.	
		habitat specialists/obligates	Terrest.	
		Pika metapopulations	Terrest.	
		Songbird communities	Terrest.	
		Secondary boring beetles	Terrest.	
		ungulates	Terrest.	
		bryophytes	Terrest.	
		lichens	Terrest.	
	What is the status and trend of both non-listed and listed wildlife species	Freshwater Mussels (see also above list).	Terrest, MARINE	
	What are the trends in pollinators?	pollinators (invert. And vert.)	Terrest.	

Appendix G. Vital signs scoping process and key findings, Klamath Network (continued).

Subcategories	Monitoring Question	Vital Sign (Klamath)	Question Identified by	Comments (June 04 SAC)
	What are status and trends in rare plants?	rare vascular and nonvascular plants	WHIS	
	What factors affect rare plants?	research question		
Marine Aquatic	What are long term trends, abundance, distribution, demographics especially productivity, of focal species/ communities?	Invertebrates/algae communities and/or populations	REDW, MARINE	Percent community cover and composition in low, mid and upper tidal rocky zones and submarine vertical rocky habitat; algae/invertebrate population distribution, abundance and movement
		Common Murre Colonies	REDW, MARINE	Population, productivity at major colonies
		Gray Whales	REDW, MARINE	Population, individual identification of seasonal "residents" Klamath River mouth
		Harbor Seals	REDW MARINE	Population, production, location of haul outs and pupping sites
		Bull Kelp	REDW, MARINE	Extent cover, presence/absence, distribution
		Tide Pools	REDW, MARINE	Fish species composition, distribution, abundance, and size class – particularly juveniles of open ocean species; composition, distribution, and abundance of invertebrate communities/populations
		Flat Fish	REDW, Marine	Species composition, size class, distribution and abundance

Appendix G. Vital signs scoping process and key findings, Klamath Network (continued).

Subcategories	Monitoring Question	Vital Sign (Klamath)	Question Identified by	Comments (June 04 SAC)
		Estuarine Aquatic Plants	REDW, Marine	Species composition, distribution, extent cover
	What are status and trends in Ballast water that could introduce species	plants and inverts.(Attached to substrate)	Marine	
	What is the extent of estuarine habitat in Redwood?	inventory question	Marine	
	Coastal habitat type extent	inventory question		
	What is the extent of coastal habitat types?	inventory question	REDW, Marine	Need baseline information of coastal habitat types for entire 36 miles of park coastline
	What is the coastal bathymetry of the offshore waters of REDW?	inventory question	REDW, MARINE	Need baseline information of coastal bathymetry for offshore park coastline waters
	What are the roles of estuaries for anadromous fishes, and how does it compare with streaMarine that empty directly into the ocean?	research question	Marine	reword into monitoring question?
Marine Aquatic	What is the role of seasonal and inter-annual variation in wetland function?	research question	Marine	reword into monitoring question?
	What are the roles of estuaries as nurseries for marine fishes?	monitoring Q	Marine	reword into monitoring question?
	What are the roles of estuaries for resident fishes (threespine stickleback, sculpin)?	research question	Marine	reword into monitoring question?
	What are the keystone species in the estuaries? Are they	research/inventory question	Marine	reword into monitoring question?

Appendix G. Vital signs scoping process and key findings, Klamath Network (continued).

Subcategories	Monitoring Question	Vital Sign (Klamath)	Question Identified by	Comments (June 04 SAC)
	missing?			
	Do we have a comprehensive list of T&E or sensitive species in these habitats?	inventory question	Marine	reword into monitoring question?
Freshwater Aquatic	What are long term trends, abundance, distribution, demographics especially productivity, of focal species/ communities?			
	Are the population stability/community structure/ of fish assemblages changing over time	fish (fish assemblages)	Terrest., Aquatic	
	Are the population stability/community structure/ of amphibian assemblages changing over time	Amphibians (amphibian assemblages)	Terrest., Aquatic	
	Are the population stability/community structure/ of primary producers changing over time	aquatic macrophytes	Aquatic	
	Are the population stability/community structure/ of consumers changing over time	invertebrates (MI, mollusks, crayfish)	Aquatic	
Freshwater Aquatic	Are the population stability/community structure/ of bird communities changing	bird communities	Aquatic	

Appendix G. Vital signs scoping process and key findings, Klamath Network (continued).

Subcategories	Monitoring Question	Vital Sign (Klamath)	Question Identified by	Comments (June 04 SAC)
	over time			
	Status and trends in wetland ,riparian communities?	Wetland, riparian plant communities, wildlife	WHIS	
	How are rare environments (ice caves, fens, serpentine bogs, lagoons, geothermal springs, limnocrene, etc.) changing over time?	monitoring rare aquatic habitats	Aquatic	
Subterranean	How are anthropogenic changes affecting the biotic web? (rephrase)	Organic Input (research Q)	Cave	
		Subsurface Arthropods	Cave	
		Mycorrhizae response to exotics, soil changes (esp. nutrients & water)	Cave	
		Bats	Cave, Terrest.	
		Entrance Flora and Fauna	Cave	
		Sediment Microbial Community	Cave	
		Woodrat Nests	Cave	
		cave entrance communities	Terrest.	
At-risk Biota		special status	Terrest.	

Appendix G. Vital signs scoping process and key findings, Klamath Network (continued).

Subcategories	Monitoring Question	Vital Sign (Klamath)	Question Identified by	Comments (June 04 SAC)
		species		
	What is the rate and extent (biotic and abiotic) of biotoxin accumulation?	Bioaccumulation in organisMarine toxins / contaminants	Process, Terrest.	
	What are the status and trends in T& E species	T&E species	Terrest., Aquatic	
		Brown Pelican	REDW MARINE	Abundance, distribution, and demographics at major offshore and beach roosts
		Steller's Sea Lion	REDW MARINE	Population, production, and demographics at rookery
	What are the are status, distribution, and size class of T&E fish species?	Salmonids (Chinook and Coho salmon, Steelhead Trout, Tidewater goby)	REDW MARINE	Juvenile population, size class for each species in estuary and mainstem
Dominant Communities			Process	
	What are the long term trends in the predominant habitat types?	cover of habitat types	Terrest.	
		vegetation dynamics	Terrest.	
		common communities	Terrest.	
	What are the long term trends in gap distributions?	Gap distribution	Terrest., Process	

Appendix G. Vital signs scoping process and key findings, Klamath Network (continued).

Subcategories	Monitoring Question	Vital Sign (Klamath)	Question Identified by	Comments (June 04 SAC)
	What are trends in spatial and temporal extents of predominant habitats	Temporal and spatial extents	Terrest., Process	
	What are long term trends in the vertical and horizontal structure of predominant habitats	Vertical and horizontal structure	Terrest.	

Appendix G. Vital signs scoping process and key findings, Klamath Network (continued).

Table 6. Monitoring questions and potential vital signs for National Framework, level 1, Human Use category.

Subcategories	Monitoring Question	Vital Sign Klamath	Question Identified by	Comments (June 04 SAC)
Interactions	What is the level of collaboration between private, tribal, NGO's, academic, federal, and state agencies?	partnerships, Social Science Res. Q. , Park Management Q.	Process	
	how are agency management actions affecting estuaries (flood control, breaching berMarine, wetlands, uplands, etc)		Marine	
Cultural Resources	How are culturally important natural resources changing?	Forests, Wildlife, Viewsheds	VS	
	How are culturally important natural resources linked to biological integrity?	research question	Process	
	How does the continuation of traditionally important uses of resources affect biological integrity of the ecosystem?	research question	Process	
	What are impacts of Cultural Gathering?	research question	Process	
	What is the effect of historical developments (roads, building sites with contaminants, etc.	Research question	Process	
	What are the effects of roads (and xc ski and snowmobile corridors on wildlife migration? I	wildlife migration	CRLA	
	What are impacts due to water withdrawals? What are the effects to instream flow and downstream delivery (e.g. Klamath River)?	stream diversions (withdrawals)	CRLA	See also water

Appendix G. Vital signs scoping process and key findings, Klamath Network (continued).

Subcategories	Monitoring Question	Vital Sign Klamath	Question Identified by	Comments (June 04 SAC)
	What are patterns (current and predicted) and attributes of human population increase and development around park units?	human populations around parks	CRLA	see also Ecosystem pattern and processes
	What are the collective and cumulative impacts of providing for public and employee safety? (E.g. removing hazard trees, problem wildlife, pest management, SAR operations, fuels thinning. etc).	safety measures undertaken in parks	CRLA	
Point Source Human Effects	Are our fire management practices restoring natural fire regimes?	Research question	Terrest.	
	What are trends in fire allowance with trends in terrestrial communities?	fire control	Terrest.	
	Prescribed fire- timing		Terrest.	
	Suppression		Terrest.	
	Wildland fire use		Terrest.	
	What are status and trends in Fishing boats/lights	Roosting and foraging brown pelicans, sealions and seals at haulout sites and foraging	Marine	Number of encounters with brown pelicans, Steller's Sealion and harbor seals
	What are effects of mining, geothermal exploration and development?	Water quality, bioaccumulation	WHIS, CRLA	
Point Source Human Impacts	What are effects of utility corridors	non-native species	WHIS	
	What are the effects of Park Infrastructure Developments and Maintenance of those areas	reduced infiltration , increased runoff from parking lots, exotic plant distribution, soil compaction, wildlife disturbance	LABE	

Appendix G. Vital signs scoping process and key findings, Klamath Network (continued).

Subcategories	Monitoring Question	Vital Sign Klamath	Question Identified by	Comments (June 04 SAC)
	What are effects of prescribed fire?		WHIS	
	What are the status and trends in Over flights	nesting sea bird behavior and marine mammal at haulout sites, soundscapes	Marine	Common Murres and cormorants nesting rocks, Steller's sealion and harbor seals
	What are the effects of shoreline engineering projects	estuary morphology	Marine	Changes to berm and longitudinal profiles
	How are roads affecting aquatic habitats?	research question, roads and trails	Aquatic	
	What are effects of roads for weeds?	research question	WHIS	
	What are effects of fuelbreaks?	research question	WHIS	
	What are effects of daMarine?		WHIS	
	General effects of maintenance?	soil compaction, exotic plant distribution and spread	WHIS	
	how is road removal effecting aquatic environments?	restoration (road)	Aquatic	
Non-point source Human Effects	What is the change in light pollution over time?	Percentage of night sky in each park	Terrest.	
Consumptive use	What are effects and trends due to fishing?	rock fish and flat fish	Marine, Aquatic	Age and size class of Ling cod and flat fishes.
	What are the effects of illegal stocking of fish	recreational fishing	Aquatic	

Appendix G. Vital signs scoping process and key findings, Klamath Network (continued).

Subcategories	Monitoring Question	Vital Sign Klamath	Question Identified by	Comments (June 04 SAC)
Commercial Resource Extraction	What are the trends and effects due to illegal harvesting of park resources (e.g. elk, mushrooMarine, plants, herps, forest products, salmonids)?	Roosevelt elk, salmonids, ling cod, rock fish.	REDW, CRLA	Poaching incidences, elk herd counts. Age and size class distribution using hook and line sampling (ling cod). Species composition, spatial distribution, age class distribution, size class using SMRF sampling (trawl method), for rock fish
	What is the extent of commercial fishing in offshore park waters and what is the potential impact to park marine resources	Commercial Fish Catch	REDW MARINE	Catch location, species composition and age class distribution using commercial landing reports from CDFG
Visitor and Recreation Use	Are patterns in visitor use, resource extraction, and park management activities associated with trends in terrestrial communities?	wildlife	Terrest.	
		wildlife dispersal and corridors	LABE	
		threatened and endangered species	LABE	
	How do human use of park resources influence changes to terrestrial and aquatic species/populations/communities	People Use	REDW	Count cars in coastal parking lots, tide pools interpretive walk participants, numbers people on beaches, outdoor school program numbers, ad hoc visitor use surveys
	Are recreational activities and park	Vehicles on Beaches	REDW	Number of vehicle beach access permits issued

Appendix G. Vital signs scoping process and key findings, Klamath Network (continued).

Subcategories	Monitoring Question	Vital Sign Klamath	Question Identified by	Comments (June 04 SAC)
	operations affecting recovery of T&E species?	Visitor Use (hiking on trails, picnicking, horse back riding, kayaking, etc.)		Western Snowy Plover, Marbled Murrelets, Bald Eagle, Spotted Owl, Steller's Sea lion, Peregrine Falcon
	How do trends in visitor use impact terrestrial communities?		Terrest.	
	How does the need to maintain biological integrity of a system affect continual visitor use?		Process	
	What are the status and trends in Recreational boating/kayaking	marine mammal behavior	Marine, Aquatic	
	What are status and trends of vehicle use near marine birds and mammals?	nesting sea bird behavior	Marine	
	What are the status and trends in disturbance from recreation (off road vehicle use, fishing, camping, boating, hiking)	vehicle use	??	
	what are effects of Target practice (Klamath estuary)?		Marine	Number of sea lion and harbor seal carcasses with signs of being shot
	What are status and trends of tide pool use (education, etc.)	human use (tidepools)	Marine	Visitor rates, number of people, and location extant
	What is the level of collecting from the intertidal?		Marine	Visitation rate by location
	What is the next likely recreational demand to be placed on parks and what are their likely resource impacts?	Recreation, leisure activity trends	CRLA	
	How can hazardous spills best be predicted and monitored	hazardous material storage sites	CRLA	

Appendix G. Vital signs scoping process and key findings, Klamath Network (continued).

Subcategories	Monitoring Question	Vital Sign Klamath	Question Identified by	Comments (June 04 SAC)
Caves	Which human uses are causing the greatest impacts to caves?	Human Use (caves)	Cave	
		Adjacent Land Use	Cave	
		Infrastructure (roads, buildings, parking lots, paths)	Cave	
		Vandalism	Cave	

Table 7. Monitoring questions and potential vital signs for National Framework, level 1, Ecosystem Pattern and Process category.

Subcategories	Monitoring Question	VitalSign Klamath	Question Identified by	Comments (June 04 SAC and Follow-up email)
Habitat Patterns	How are meso-habitats distributed across the landscape?	bryophyte diversity	Terrest.	
		species with narrow niches	Terrest.	
		pika	Terrest.	
	Are there trends or shifts in ecological communities?	symbiotic relationships	Terrest.	
		meadow invasion	Terrest.	
		trophic guilds	Terrest.	
		metapopulations	Terrest.	
	What are the distribution of symbiotes	Clark's nutcracker and WB pine	Terrest.	
		ants/trillium	Terrest.	
		truffles/small mammals	Terrest.	

Appendix G. Vital signs scoping process and key findings, Klamath Network (continued).

Subcategories	Monitoring Question	VitalSign Klamath	Question Identified by	Comments (June 04 SAC and Follow-up email)
Disturbance (general)	What are the disturbance regimes across the landscape?	landscape scale disturbances	Process	
	What are effects of large marine disturbances (Earthquakes/tsunamis)	Habitat change (invertebrates)	Marine	Changes in composition of invertebrate populations/communities
		coastal landslides	Marine	Number of slides aerial photos.
		marine substrata	Marine	Unknown until bathmetry inventory is completed.
	Are disturbances serving as focal points for invasive species?	invasions in disturbed areas	Process, Terrest.	
	Effects of non anthropogenic sources of major environmental change in marine systeMarine	sediment deposition, marine	Marine	Monitor meteorology (climate change) and count number of marine mammal and seabird carcasses.
Disturbance (general)	what are the natural disturbance regimes and how are they changing over time and what is the ecological response?	extreme events	Aquatic, Process	
	what is extent and distribution and severity of anthropogenic disturbance?	anthropogenic disturbance	Aquatic	
Insect disturbance	What are the trends in insect and disease dynamics?	snags	Terrest.	
	What are the trends in insect populations over time?	butterflies, cicadas	LABE	
Fire	Are our fire management practices restoring natural fire regimes?	"unnatural" fire	Aquatic	
		fuel loading	Terrest.	

Appendix G. Vital signs scoping process and key findings, Klamath Network (continued).

Subcategories	Monitoring Question	VitalSign Klamath	Question Identified by	Comments (June 04 SAC and Follow-up email)
	what are the natural fire regimes and how are they changing over time and what is the ecological response?		Aquatic	
	Does smoke affect nesting success of listed species (e.g. marbled murrelets, spotted owls)?	Threatened Species (i.e., Marbled Murrelets and Spotted Owls)	REDW	Air quality (smoke), nesting success
	Do fire interval, frequency of burns, and size of burns affect fish and wildlife species (i.e. sm. mammal, herpetofauna, bats, and salmonids)?	Small mammals (Microtus californicus in grasslands and Peromyscus maniculatus in forested habitat); herps, bats, and salmonids	REDW	Quantity of sediment, species composition of each taxa
Land use	How is land use and land cover changing in and around parks?	land cover	Process, Terrest., Marine, Aquatic	
Land cover	Intensive land use (logging, cultivation, grazing, suburban development)	land use	Process, Terrest., Marine, Aquatic	
	how is road density changing	road density	Process, Terrest., Marine, Aquatic	
	How are Connectivity and fragmentation changing	landscape pattern		

Appendix G. Vital signs scoping process and key findings, Klamath Network (continued).

Subcategories	Monitoring Question	VitalSign Klamath	Question Identified by	Comments (June 04 SAC and Follow-up email)
	What is the connectivity of old growth forests?		Process	
	Does connectivity of fragmented old-growth forests within and outside of park boundary influence animal movement and improve gene flow?	Mountain Lion, Fisher	Terrest.	VSP/ REDW
	Are modified landscapes moving toward potential natural vegetation?	2nd growth forests	Terrest.	
		Ponderosa pine forests	Terrest.	
		chaparral	Terrest.	
		sagebrush	Terrest.	
		grassland	Terrest.	
		oak woodlands	Terrest., Process	
		riparian	Process	
	How is level of ecological insularity changing over time?		Terrest., Process	
Nutrient dynamics	What are changes in nutrient flow dynamics?	macronutrients	Terrest.	
	What are the trends in selected nutrient availability? (focus à heavily disturbed areas)	standing biomass (carbon loading)	Terrest., Process	
Productivity	What is the rate and production of coarse woody debris?	woody debris (terrestrial)	Marine	
	What are status and trends of woody debris on beaches	woody debris on beach	Marine	

Appendix G. Vital signs scoping process and key findings, Klamath Network (continued).

Subcategories	Monitoring Question	VitalSign Klamath	Question Identified by	Comments (June 04 SAC and Follow-up email)
	What levels of primary productivity occur in the park estuaries? Where does the carbon come from? Water column? Upstream? StreaMarineide vegetation? Inwash from ocean? Proportions of each?	research question	Cave	
Natural landscapes	What interactions between taxa and geology most affect ecosystem patterns & processes?	Fire Regimes, weather, precipitation, water infiltration	Cave	
		Nutrient Cycling	Cave	
		Invasives	Aquatic	
		soundscape	Aquatic	
		lightscape	Aquatic	
		odorscape	Aquatic	
		viewsheds		
Ocean Processes		Waves	REDW MARINE	Wave spectra – especially height, period, (existing NOAA buoys will give offshore characteristics, but need to establish nearshore wave characteristics). Wave action drives nearshore currents.
		Tides	REDW MARINE	Daily fluctuations using Crescent City harbor NOAA monitoring station
		Nearshore Currents	REDW MARINE	Direction and speed. Need to establish nearshore instruments in-park to gather baseline information and conduct periodic measurements thereafter. Nearshore currents drive the seasonal

Appendix G. Vital signs scoping process and key findings, Klamath Network (continued).

Subcategories	Monitoring Question	VitalSign Klamath	Question Identified by	Comments (June 04 SAC and Follow-up email)
				upwelling system.

Appendix G. Vital signs scoping process and key findings, Klamath Network (continued).

Attachment I. Summary of Geologic Mapping Status for Klamath Network.

Park	Scale	Park boundary covered	Full Qoi covered	Reference	Pub.	Digitized	notes
CRLA	24000	Not all; it's a rectangular map and park is not rectangular	No	Charlie Bacon (USGS), Geologic map of CRLA area, 24k, estimated publication in 2005	Not yet	yes, but we can only get a copy when it goes to publication	Doesn't cover full park boundary, so it won't fulfill our GPRA goal; need to get rest of park somehow
CRLA	62500	No; south of park boundary but in qoi	no, but 4 fully covered	Smith, J.G., 1988, Geologic map of the Pelican Butte quadrangle, Klamath County, Oregon, USGS, GQ-1653, 1:62500 scale	Yes	No	Could use to fill in qoi's to south
CRLA	125000	No, only north quarter of park	No, but 12 are covered	Sherrod, D.R., 1991, Geologic map of a part of the Cascade Range between latitudes 43 degrees - 44 degrees, central Oregon, USGS, I-1891, 1:125000 scale	Yes	No	Coarse scale probably mapped at 62.5 though; could use for northern qoi's though
CRLA	125000	No, but much	No, but 20 fully covered	Moring, Barry, 1983, Reconnaissance surficial geologic map of the Medford 1x2 quadrangle, Oregon-California: USGS, MF-1528, scale 125,000	Yes	No	Surficial map; could use to fill in qoi's
CRLA	62500	No	No, but 6 fully covered	Smith, J.G., 1983, Geologic map of the Sky Lakes Roadless area and Mountain Lakes Wilderness, Jackson and Klamath counties, Oregon: USGS, MF-1507-a	Yes	No	Could use to fill in qoi's to south
LABE	24000	Yes	No	Donnelly-Nolan, Julie M.; Champion, Duane E., 1987, Geologic map of Lava Beds National Monument, northern	Yes	Yes, by park; needs metadata. Not sure if all attributes captured from	GRE has copy of ArcView files; need to review for full attribution capturing

Appendix G. Vital signs scoping process and key findings, Klamath Network (continued).

Park	Scale	Park boundary covered	Full Qoi covered	Reference	Pub.	Digitized	notes
				California, USGS, I-1804, 1:24000 scale		source map	
LABE	50000	Yes	No, but several are included	Donnelly-Nolan, Julie M. unpublished (maybe 2005, Geologic map of the Medicine Lake Volcanic area, USGS, 1:50000 scale	Not yet	yes, but we can only get a copy when it goes to publication	Full publication should be available as paper and digital in 2005; LABE needs to make sure they concur with the presentation of the lava tube openings that USGS currently has. Charlie Bacon gave GRE a paper copy of the preliminary map for now. Dave Larsen has a better prelim print out with 2 sheets; it looks very good and promising; covers many qoi, but not necessarily all because it is not a rectangular map
LAVO	50000	Yes	Yes	Mike Clynne 1:50k map of greater LAVO area, hopefully out within a year	Not yet; in progress	Will be	We'll be waiting awhile longer; just like we were told in September 2000
LAVO	24000	No, just small part of lassen peak	No	Christiansen, Robert L.; Clynne, Michael A.; Muffler, L.J. Patrick, 2002, Geologic map of the Lassen Peak, Chaos Crags, and Upper Hat Creek area, California, USGS, I-2723, 1:24000 scale	Yes	Yes	Already have digital version for GRE; need to capture all attribution
ORCA	Large (unknown); covers present park boundary, but not full qoi	Yes, present park boundary, not expanded though	No	In-house geologic map of Oregon Caves NM by John Roth and Len Ramp	No	Yes, ArcView files; park is using; not much ancillary information though	Extends slightly beyond present park boundary, but not to new proposed park hboundary (which GRE needs from the park)
ORCA	24k	Yes (western unit)	Yes, but only the Cave Junction at 1:1	Ramp, Len, 1986, Geologic map of the NW quarter of the Cave Junction [15'] quadrangle, Josephine County, Oregon Department of Geology and Mineral Industries, Series 38, 1:24000 scale	Yes	No, according to Tom Wiles	John says we don't need to worry too much about this part of park for natural resource concerns because only a visitor center is there and is not a top priority
ORCA	Large	Yes	No	Senior thesis from	No	Maybe by	John supervised this project and had it

Appendix G. Vital signs scoping process and key findings, Klamath Network (continued).

Park	Scale	Park boundary covered	Full Qoi covered	Reference	Pub.	Digitized	notes
	(unknown, but likely at least 24k); covers proposed park expanded boundary, but not full qoi			Scotland (University of Edinburg, Jason ____ (John Roth not sure of name); produced around 2000		author, but park doesn't have copy	mapped to the new proposed boundary for the park. John would like this to serve as the dedicated park map and will contact student to get the map so it can be digitized. GRE offered to digitize it
ORCA	125k	Yes	Yes, all 5	Ramp, Len and Peterson, N.V., 1979, Geology and mineral resources of Josephine County, Oregon, Oregon Department of Geology and Mineral Industries, Bulletin 100, 1:125000 scale	Yes	Will be digitized by OR GS	Could be used to fill in to full QOI's if desired because it covers all 5
ORCA	3500	Yes	No	Friday, John, 1983, Debris flow hazard assessment for the Oregon Caves NM: USGS, WRI-83-4100, scale 1:3500	Yes	Unknown	John says it's a map of the 1964 debris flow so is dated, but he'd still like it digitized by GRE
REDW	250,000	Yes	Yes	Strand, R.G., 1963, Geologic Map of California-Weed Sheet: California Division of Mines and Geology, scale 1:250,000	Yes	No or unknown	Very coarse, but park is using it; check index map to find its sources of mapping to see if there are larger scale pubs.
REDW	100,000	No, south qoi's	No, just 19 qoi to south	McLaughlin, R.J., Cecil, J.D., Cyr, K.A., Ellen, S.D., Blake, M.C., Jayko, A.S., Irwin, W.P., Aalto, K.R., Carver, G.A., Clarke, S.H., and Barnes, J.B., 2000, Geology of the Cape Mendocino, Eureka, Garberville, and southwestern part of the Hayfork 30 X 60	Yes	Yes; I downloaded it	ArcInfo coverages; very usable
REDW	62500	No, but most of south half	No	Harden, D.R., Kelsey, H.M., Morrison, S.D.,	Yes	Yes, by park; GRE has copy;	Very usable for southern half of park

Appendix G. Vital signs scoping process and key findings, Klamath Network (continued).

Park	Scale	Park boundary covered	Full Qoi covered	Reference	Pub.	Digitized	notes
		of park		and Stephens, T.A., 1981, Geologic map of the Redwood Creek drainage basin, Humboldt County, CA: USGS OF-81-496, scale 1:62,500		need to see if all features captured	
WHIS							Already digitized by GRE as per TA request of Brian Rasmussen; No further action required